IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
Group Art Unit 1742

In re

Patent Application of

Laxmi C. Tandon, et al.

Application No. 10/685,097

Confirmation No. 5500

Filed: October 10, 2003

Examiner: George P. Wyszomierski

"HIGH TENSILE STRENGTH GRAY IRON ALLOY"

SECOND DECLARATION OF LAXMI C. TANDON PURSUANT TO 37 C.F.R. § 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Laxmi C. Tandon, declare as follows:

1. I currently reside at 3508 Zermatt Court, Rockford, Illinois 61114, United States of America.

2. I am the Senior Metallurgist of Gunite Corporation ("Gunite"), which is the owner of the above-referenced patent application ("Application"). I am also a joint inventor of the subject matter disclosed in the Application.

3. I obtained a Bachelor of Science degree in Metallurgical Engineering from Banaras Hindu University, India, in 1963. I also obtained a Master of Science degree in Materials Science from State University of New York at Stony Brook in 1977. Further, I

obtained a Professional Degree (consisting of Ph.D. level courses) in Mineral Engineering (Extractive Metallurgy) at Columbia University, New York City in 1978.

4. I have been involved in metallurgy for 43 years, have worked with gray iron alloys for 25 years, and have been involved in the development of lightweight brake drums for the last 10 years. During this time, I have created several new and improved gray iron alloys. While I have been employed with Gunite, it has sold at least 6 types of brake drums totaling over 30 million brake drums manufactured from many of my various new and improved gray iron alloys. Accordingly, I have an excellent understanding of the large variety of gray iron alloys and braking components that exist in the marketplace.

5. I understand that in the art of gray iron brake drums it is desirable to have a gray iron brake drum with a fine microstructure and reduced free ferrite. The present invention has a fine microstructure and reduced or no free ferrite due to a cooperative effect of Mo and Cu (see Appendix A), while Lawrence obtains a fine microstructure and reduced free ferrite by introducing Sn into the compositions. For purposes of comparison, reference is made to Appendix B where two gray iron microstructures are illustrated having 3% and 27% free ferrite, respectively, and the free ferrite is identified by reference letter "F". It is undesirable to add Sn to the present invention because increased presence of Sn in a composition decreases the machinability of a product as evidenced in Appendix C. Levels of Sn disclosed in the compositions of Lawrence (0.02% to 0.07% of Sn) greatly decrease the machinability of the brake drums (see Appendix C).

6. I am aware of and familiar with the composite brake drum disclosed in Lawrence ("Lawrence Brake Drum") in the marketplace. The Lawrence Brake Drum is sold in the marketplace under the name Centrifuse®, which is manufactured and sold by Hayes Lemmerz International, Inc. I know that the Centrifuse® brake drum is the composite brake drum disclosed in Lawrence for following reasons:

a) Gunite acquired a Centrifuse® brake drum, several photos of the Centrifuse® brake drum were taken and such photos included a photo of the trademark "Centrifuse®" (see Appendix D), a photo of the manufacturer symbol (see Appendix E) that represents Hayes

Lemmerz International, Inc., and a cross-sectional photo of the Centrifuse® brake drum (see Appendix F);

b) I understand that the Lawrence patent is assigned to Hayes Lemmerz International, Inc. (see Appendix G);

c) I understand that the trademark "Centrifuse®" is owned by Hayes Lemmerz International, Inc. (see Appendix H);

d) I compared the cross-sectional photo of the Centrifuse® brake drum to the cross-sectional view of Lawrence (see Appendices F and I, respectively);

e) The cross-sectional photos of Lawrence and the Centrifuse® brake drum are substantially the same;

f) I cut a fragment from the Centrifuse® brake drum and performed a composition test on the fragment using accepted and known methods called Spectro (Spectrometer) and LECO CS-200 (carbon only);

g) The chemical composition of the Centrifuse® brake drum and the chemical composition ranges disclosed in the Lawrence patent are as follows (represented in weight percentage of composition):

Centrifuse® Composition	**Lawrence Disclosure**
C = 3.46 %	C = 3.4 % to 3.65%
Mn = 0.59 %	Mn = 0.4 % to 1.0 %
Si = 2.06 %	Si = 1.0 % to 2.5 %
S = 0.071 %	S = less than 0.12 %
P = 0.021 %	P = less than 0.15 %
Cr = 0.11 %	Cr = 0.2 % to 0.5 %
Ni = 0.05 %	Ni = None
Mo = 0.41 %	Mo = 0.25 % to 0.75 %
Cu = 0.64 %	Cu = 0.3 % to 1.0 %
Sn = 0.05 %	Sn = 0.02 % to 0.07 %
Carbon Equivalent (CE) = 4.15 %	Carbon Equivalent (CE) = 3.73% - 4.53%, calculated but not disclosed by Lawrence

h) From this chemical composition analysis and all of the other information, I believe that the Centrifuse® brake drum is the brake drum disclosed in Lawrence.

7. Since the Centrifuse® brake drum is believed to be the composite brake drum disclosed in the Lawrence patent, field tests were performed by a Gunite employee on the Centrifuse® brake drum to determine whether the present invention has substantially improved properties over the Centrifuse® brake drum.

8. Gunite field tested three Centrifuse® brake drums and three non-composite brake drums made from the present invention. The three Centrifuse® brake drums were placed on three different axles of a truck and the truck was driven under normal operating conditions. The three brake drums made from the present invention were placed on three different axles of another truck and the truck was driven under normal operating conditions similar to the normal operating conditions of the Centrifuse® truck. The acquired field test data is as follows:

Field Test Data Conducted on Centrifuse® and Present Invention Brake Drums

Tested Product	Drum Part #	Projected Miles	Drum Wear (Left Side)	Drum Wear (Right Side)	Axle
Present Invention	9006X	393,360	0.001	0.005	Axle-1
Present Invention	9006X	196,680	0.01	0.005	Axle-2
Present Invention	9006X	281,040	0.006	0.007	Axle-3
Centrifuse	89996B	82,080	0.016	0.018	Axle-1
Centrifuse	89996B	92,400	0.016	0.013	Axle-2
Centrifuse	89996B	92,400	0.015	0.016	Axle-3

The average wear, in inches, for the Centrifuse® brake drum is 0.0157 and the average wear, in inches, of the non-composite brake drum of the present invention is 0.0057. The Centrifuse® brake drums wore almost 3 times more than the non-composite brake drums of the present invention. From these average wear dimensions, an average projected life can be calculated. The average projected life of the Centrifuse® brake drums is 88,960 miles and the average projected life of the brake drums of the present invention is

290,360 miles. The brake drums of the present invention have a projected life of more than 3 times that of the Centrifuse® brake drums.

9. Prior to filing the present application, tests were conducted on a pair of Centrifuse® brake drums. The results of these tests on the Centrifuse® brake drums were included in the present application in Table 1 (see Appendix J) and identified as "Sample G". From Table 1, the present invention brake drums (identified in Table 1 as HT50) clearly outperformed the Centrifuse® brake drums. The present invention brake drums averaged 97 stops and the Centrifuse® brake drums averaged 16 stops. Accordingly, the present invention substantially outperformed the Centrifuse® brake drums by more than 6 times. Also, the present invention brake drums had an average deceleration rate of 19.91 ft/sec^2, while the Centrifuse® brake drums had an average deceleration rate of 19.19 ft/sec^2. This means that the present invention brake drums stopped faster than the Centrifuse® brake drum. Again, the present invention brake drums outperformed the Centrifuse® brake drums.

10. From these tests, I believe that the brake drums of the present invention have substantially improved properties over the Centrifuse® brake drums, which are the same composite brake drum disclosed in Lawrence. Accordingly, the brake drums of the present invention have substantially improved properties over Lawrence.

11. I understand that Lawrence teaches composite brake drums (see Appendices F and I), while the present invention relates to non-composite brake drums (see Appendix K). A composite brake drum includes a gray iron portion (the brake surface) surrounded by a steel shell to support the gray iron portion. A non-composite brake drum does not have a steel shell. Non-composite brake drums have high thermal conductivity necessary for a brake drum to properly dissipate heat and control crack propagation, while composite brake drums have poor thermal conductivity due to the steel shell acting as an insulator to the gray iron portion of the brake drum by inhibiting heat dissipation. Poor thermal conductivity promotes crack propagation through the brake drum, thereby decreasing the life of the brake drum. Reference is made to Appendix L where the thermal conductivity of iron and steel are highlighted to illustrate

how gray iron dissipates heat much better than steel and how steel can act as an insulator due to the poor thermal conductivity. Particularly, at the outer surfaces of non-composite and composite brake drums, the non-composite brake drums can have about 45% higher thermal conductivity than composite brake drums. Composite brake drums also cause what is known in the art as a "chill effect", which adversely effects thermal conductivity of a composite brake drum. Chill effect occurs during molding of the composite brake drum when the gray iron contacts the steel shell and cools quickly. Quickly cooling gray iron tends to cause carbon not to form in a free form, when it is desirable in the art of brake drums for carbon to form in the free form. The lower the amount of free form carbon in a brake drum, the lower the thermal conductivity of the brake drum. Again, lower thermal conductivity promotes crack propagation, thereby decreasing the life of the composite brake drum. In addition, the steel shell of a composite brake drum is corrugated (see Appendices F and I). The corrugation causes substantial variation in the thickness of the gray iron brake surface, thereby creating substantial variation in the thermal conductivity of the brake surface. Consequently, the brake surface of a composite brake drum wears out unevenly, and it cannot be resurfaced. For these reasons, I believe that the composite brake drums of Lawrence are different than, and teach away from the non-composite brake drums of the present invention.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like are punishable by fine and imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

August 28, 2006 | Laxmi C. Tandon

Date | Laxmi C. Tandon